



Darwin Initiative Main Project Annual Report

Important note: To be completed with reference to the Reporting Guidance Notes for Project Leaders:

it is expected that this report will be no more than 10 pages in length, excluding annexes

Submission Deadline: 30th April 2017

Darwin Project Information

Project reference	23-021
Project title	Promoting biodiversity in sustainable oil-palm landscapes for West African smallholders
Host country/ies	Ghana
Contract holder institution	University of Leeds, UK
Partner institution(s)	Nature Conservation Research Centre, Ghana University of York, UK Kwame Nkrumah University of Science and Technology, Ghana Solidaridad, West Africa Roundtable for Sustainable Palm Oil, Malaysia
Darwin grant value	£327,744
Start/end dates of project	1 st April 2016/31 March 2019
Reporting period (e.g., Apr 2016 – Mar 2017) and number (e.g., Annual Report 1, 2, 3)	Annual Report 1; Apr 2016 – Mar 2017
Project Leader name	Professor Keith Hamer
Project website/blog/Twitter	http://www.fbs.leeds.ac.uk/staff/Hamer_K/ . Numerous tweets from project staff tagged @Darwin_Defra
Report author(s) and date	Keith Hamer, Rebecca Asare, Jane Hill (Project Steering Committee); April 2017

1. Project rationale

Palm oil is a globally important edible oil that governments in western Africa are increasingly targeting as a key sector for agricultural growth and to address rural poverty. Most oil-palm growers in the region are smallholder farmers who rely on cultivation for both income and household consumption. For instance in Ghana, ~90% of the land cultivated for oil-palm (~400,000ha) comprises smallholdings. Ghana also supports >550 species of rainforest birds, of which about 20 are globally threatened according to the IUCN, and >900 species of butterflies, of which about 100 are endemic to western Africa and threatened by forest loss. Ghana plans to expand smallholdings by a further 150,000ha over the next 5-10 years, making it vital to provide smallholders with tools and guidance to help them develop sustainable agricultural practices that optimise economic returns, reduce biodiversity losses and environmental threats, and ensure the protection of high conservation value rainforest.

Growing markets in sustainably-sourced palm oil provide ideal opportunities for smallholders in Ghana to boost their incomes through take-up of best agricultural practice (BAP) to increase yields, reduce economic and environmental costs of reliance on fertilizers and pesticides, and increase crop value through RSPO-certification as sustainable growers. Certification also ensures a commitment by smallholders to the continued protection of rainforest that supports high conservation values (HCVs). However, smallholder uptake of both BAP and RSPO-certification is very low, largely through uncertainties over the yield benefits attainable from BAP, poor knowledge of how to apply BAP, and a lack of scientifically-robust and cost-effective means for smallholders to identify and prioritise HCV-forest for sustained protection, as required for certification. By addressing these issues, this project will promote sustainable oil-palm cultivation that boosts smallholders' incomes and ensures the long-term protection of rainforest supporting high biodiversity.



The project focuses on two smallholder communities in the villages of Assin Juaso and Assin Homaho in the vicinity of Assin Foso, a small township in the Central Region of Ghana (Plate 1). These two villages are embedded in a mixed agricultural landscape comprising a diverse range of herbaceous and tree crops, together with patches of forest of varying size and integrity, including Kakum National Park covering an area of 375 square kilometres.

Plate 1. Map of Ghana showing location of focal smallholder communities (blue circle)

2. Project partnerships

This project arose from presentations and discussions during an international workshop on oil palm held at the University of Leeds in 2015 and attended by several project partners. All partners were involved in planning the project and recognized its importance from the outset, as attested by their letters of support accompanying the original grant application. The partnership has since been formalised and cemented by a written Academic Partnership Agreement, signed by representatives from each partner institution (Annex 4). The project Steering Committee, comprising members from three of the project's six partner institutions, met regularly during the past year to plan and evaluate progress, including Skype meetings approximately every two months and face-to-face meetings in Ghana on three occasions (July 2016, Feb 2017 and April 2017).

Meetings in Ghana were accompanied by discussions with remaining project partners, often over a period of several days in the field, for further planning and evaluation of progress (Plate 2).

Project planning with Ghana oil palm small holders [@RSPotweets](#)
[@Darwin Defra](#) [@KeithCHamer](#)



Plate 2. Tweet from 26 July 2016 showing project partners Keith Hamer, Rebecca Asare and Winston Asante with smallholders in Assin Juaso

Particular strengths with this partnership are: the complementarity in the skills, experiences and interests of the different partners; the establishment of a Project Steering Committee at the outset of the project to oversee planning and evaluation of progress; the clearly-defined roles of each partner, and; the key role of NCRC as Project Co-ordinator in Ghana.

3. Project progress

3.1 Progress in carrying out project Activities

All the project's activities for this year have been fully implemented, as detailed below. One activity was amended through a formal change request, following changes to the UK Home Office Tier 4 visa regulations:

Activity 1.1 Two graduate Darwin Research Fellows (DRFs) were recruited to the project from partner organizations NCRC and KNUST at the start of the project (Plate 3).



Plate 3. Darwin Research Fellows Linda Ofosuhenne and Michael Sasu sorting invertebrate biodiversity samples at the project's fieldwork base in Assin Foso.

Activity 1.2 The DRFs did not visit the UK this year because overseas students are no longer permitted to study part-time in the UK, following changes to Tier 4 UK Study Visa regulations. They will now each register full-time for an MSc by Research at the University of Leeds, commencing October 2017. This will entail each DRF spending 12 months in the UK receiving appropriate training as planned, completing identification of invertebrate biodiversity samples and writing up their results before submitting their theses in September 2018. This change was approved following submission of a change request in December 2016 and highlighted in the Year 1 HYR.



Plate 4 Contrasting oil palm treatments; normal practice (left) and Best Agricultural Practice (right)

Activity 2.1 The Best Agricultural Practice (BAP) experiment is underway and on schedule for completion in July 2017. This has entailed: (i) Establishing contact with our two focal smallholder communities and holding initial workshops in each village to explain the project's aims and approach (July 2016; Plate 2); (ii) Obtaining ethical approval from the University of Leeds Research Ethics Committee, following a thorough ethical review of the project (August 2016; Annex 5); (iii) Completion, approval and signing of a comprehensive field risk assessment and Data Management Plan (August 2016; Annex 6 & 7) ; (iv) One-to-one interviews with >100 smallholders expressing interest in participating in the project, including dissemination of Smallholder Information Sheets (Annex 8) and signing of Consent Forms

(Annex 9); (v) Assignment of 40 smallholders to one of two treatment groups (implementation of BAP or not), followed by site visits to confirm characteristics of smallholdings in each treatment (September – December 2016; Plate 4); (vi) Collection of data on environmental conditions (temperature, light, vegetation and soil) and biodiversity (birds, ants, butterflies, moths and termites) using standardised protocols at a total of 100 research plots across the smallholdings in the experiment and in rain forest (February – July 2017; Plates 3 & 5), and (vii) Obtaining data on yields (fresh-fruit bunch weights) and prices obtained by each smallholder. In practice, obtaining data direct from smallholders has proven unreliable and so we are now employing a member of each smallholder community, equipped with suitable scales, to weigh harvested fruit bunches and convey data to the DRFs.

Activity 2.2 One-to-one interviews were held with >100 smallholders using a survey questionnaire to obtain data on crop management, socio-economic and environmental variables (September - December 2016; Annex 10).



Plate 5 Sampling butterflies and moths (left) and identifying a collected specimen (right)

3.2 Progress towards project Outputs

Output 1. Two graduate Darwin Research Fellows have been appointed to the project. They are each qualified to BSc level and on schedule to be awarded the degree of MSc by Research at the University of Leeds, UK during the project, including training to design and carry out field experiments and to analyse, interpret and report data obtained (see Section 2 above).

Output 2. Surveys of >100 smallholders have been completed and GPS co-ordinates recorded (Annex 11) for analysis contributing to reports on socio-economic and logistical constraints on both women and men from realizing income benefits of increased FFB yields (Indicator 2.1). The Best Agricultural Practice experiment is running on schedule and surveys of biodiversity and yields are underway (see Section 2 above), with monthly data records shared among project partners via Dropbox (Annex 12; Indicator 2.2). Permission has been sought and obtained for additional census data on topographical and vegetation characteristics and biodiversity of study plots in forest (Annex 13; Indicator 2.3) to be carried out in Q1 of project Yr2.

Output 3. Initial smallholder surveys have been completed (see Output 2 above and Annex 11). No further indicators due in Yr1.

Outputs 4 & 5. No indicators due in Yr1.

3.3 Progress towards the project Outcome

Progress during Year 1 suggests that the project is likely to achieve its outcome by the end of funding and that our indicators are adequate and appropriate for measuring this outcome, as detailed below:

Indicator 0.1. Collection of data on yields and income is still underway but initial suggestions are that a doubling of yield from baseline (3-5 tonnes ha⁻¹ year⁻¹) through adoption of BAP is entirely feasible. Increases in income are less certain because of limited processing capacity by

local oil palm mills (Plate 6). This leads to frequent delays in processing fruit bunches, resulting in spoiling of the crop (e.g. production of free fatty acids, which renders the resulting oil suitable only for local consumption and sale at a low price). In recognition of this problem, Solidaridad have recently opened an additional mill close to Assin Foso, to increase processing capacity.



Plate 6. A palm oil mill in Assin Foso, showing threshing of fruit following first pressing to produce light oil (background), second pressing by hand to produce red oil (foreground) and storage of oil in barrels, each of which sells for ~ 600 Cedis (~£110).

Indicator 0.2. Initial data indicate that biodiversity within oil palm smallholdings in Ghana is much higher than in industrial oil palm plantations in SE Asia. Biodiversity surveys are still underway, but in addition to comparing broadly between BAP and non-BAP treatments, we will also be able to quantify and ordinate management intensity within each study plot using plot-level environmental data (temperature, light, vegetation and soil; see Section 2.1 above) to examine non-linear relationships.

Indicators 0.3 & 0.4. No activities were planned in project Yr1 in relation to either of these to indicators.

3.4 Monitoring of assumptions

Outcome level

Assumption 1: Current oil-palm fresh fruit bunch (FFB) yields are below maximum and can be substantially increased.

Comments: Discussions with our project partners indicate that average yields are currently below half those achieved on industrial plantations in the region, and that this is largely the result of poor agricultural practices of smallholders.

Assumption 2: There is access to markets for additional oil-palm yields.

Comments: The rapid and sustained increased in global demand for certified palm oil indicates this is very likely. The most immediate bottleneck in the supply chain is likely to be limited processing capacity by palm oil mills, and project partner Solidaridad are taking steps to increase capacity, including opening a new mill in Assin Foso in 2016.

Assumption 3: Current levels of bird and insect biodiversity in smallholdings and adjacent forest can be enhanced by BAP.

Comments: Available evidence indicates this is the case for other crops (e.g. coffee, cocoa) and hence is likely to also be the case for oil-palm.

Assumption 4: Adoption of BAP will enable smallholders to achieve RSPO certification.

Comments: We will work closely with smallholder communities, palm oil estates wishing to get their smallholder out-growers certified and RSPO agencies to facilitate this process, drawing extensively on the considerable expertise and successful experience of our project partners at

Solidaridad, and making full use of RSPO funds (their Smallholder Support Fund, RSSF) specifically for this purpose.

Assumption 5: Smallholders adopting BAP will not subsequently increase the area under cultivation at the expense of high-conservation-value rainforest.

Comments: In practice, the area of land given over to oil-palm cultivation by smallholders is set for a large increase under Ghana's Poverty Reduction Strategy, and so promoting effective land-use planning as a key component of BAP for both established smallholdings and new plantings is more important than ever. RSPO certification will ensure that high conservation value forest within areas designated for expansion is fully protected from replacement by oil-palm, whereas it is currently highly vulnerable.

Output level

Output 1: DRFs and smallholders can be recruited to the project and remain active and fully committed to its aims and objectives.

Comments: This has been greatly enhanced by the strong links between project partners and the extensive experience and expertise of Ghanaian partners in working with rural farming communities.

Output 2: BAP experiment will yield clear results showing publishable benefits of BAP for biodiversity.

Comments: Our previous research elsewhere supports the notion that birds and insects respond quickly and are sensitive to habitat improvements

Output 3: Smallholders will attend and participate in knowledge dissemination and training events.

Comments: Our project partners' extensive experience of working with rural farming communities in Ghana strongly suggests that this will be the case.

Output 4: Smallholders wish to achieve certification for sustainability.

Comments: Evidence from RSPO shows strong support from smallholders elsewhere, and enthusiastic uptake of RSSF support once benefits of certification are evident.

Output 5: Government agencies in Ghana and neighbouring countries recognize the importance of smallholders for oil-palm production and the value of promoting sustainable cultivation that improves rural livelihoods.

Comments: CBD reports and Poverty Reduction Strategy Papers of different countries strongly indicate that this is the case.

3.5 Impact: achievement of positive impact on biodiversity and poverty alleviation

This project is improving the scientific understanding and take-up of Best Agricultural Practice for oil-palm smallholders, potentially boosting crop yields by an estimated 50-100% and hence increasing household incomes by 5,000-10,000GHC (£900-£1800) annually, while increasing biodiversity within smallholdings and adjacent forest, and promoting robust land-use planning that ensures the protection of high-conservation-value (HCV) forest throughout the planned expansion of oil-palm cultivation by smallholders (logframe indicators 0.1 – 0.4). In addition, we will directly train >1000 smallholders in rural Ghana in BAP methods, particularly benefiting

women who traditionally carry out much of the work of cultivation including application of agrochemicals and harvesting of fruit (logframe indicators 3.1 – 3.3). Each smallholder financially supports 6 family members on average, creating an additional 6000+ indirect beneficiaries. Adoption of BAP also provides additional potential benefits through RSPO certification, which we will promote through knowledge-exchange activities and networks, including through the RSPO (logframe indicators 4.1 – 4.3).

4. Contribution to the Global Goals for Sustainable Development (SDGs)

Our project directly supports SDGs 1 (no poverty), 2 (zero hunger), 8 (sustainable economic growth), 12 (responsible consumption and production) and 15 (life on land). Activities in Yr1 have promoted the uptake and retention of Best Agricultural Practice in two focal smallholder communities, targeted at increasing fruit yields, decreasing reliance on environmentally damaging agrochemicals and supporting farmland biodiversity (Plates 2 and 4). We have also made considerable and ongoing progress towards quantifying relationships between crop management and yields, income and biodiversity (logframe indicators 2.2 and 2.3); evidence that is vital to underpin policies and goals promoting the wider uptake of Best Agricultural Practice and certification as sustainable producers (logframe indicators 4.2 and 4.3).

5. Project support to the Conventions, Treaties or Agreements

Our project is helping Ghana to meet its obligations under the CBD by contributing to all five Strategic Goals of the Aichi Biodiversity Targets. We are:

Goal A

Raising awareness of the values and sustainable use of biodiversity (Target 1), integrating biodiversity values into poverty reduction strategies (Target 2) and enhancing sustainable crop production within safe ecological limits (Target 4);

Goal B

Enhancing the sustainable management of agriculture, helping to ensure conservation of biodiversity (Target 7) and bringing pollution, including from excess nutrients, to levels that do not harm ecosystem function and biodiversity (Target 8);

Goal C

Enhancing effective area-based conservation measures, fully integrated into the wider landscape (Target 11);

Goal D

Enhancing and safeguarding benefits of ecosystems services to the poor and vulnerable (Target 14);

Goal E

Enhancing scientific knowledge of biodiversity and consequences of its loss (Target 19).

Through these achievements, the project is fulfilling a major aim of Ghana's National Biodiversity Strategy and Action Plan (NBSAP) 'to pursue and promote the necessary international co-operation with donor organizations (and) development partners ... to ensure that sound policies are implemented for the sustainable use of biological resources of the nation'.

6. Project support to poverty alleviation

Oil-palm production contributes directly to the incomes of more than 3 million people in rural areas of Ghana (~10% of the country's total population) and smallholders contribute over 80% to this production. The sector accounts for much of women's labour, but is characterised by low productivity (less than half that achieved by large estates) and low incomes. By disseminating knowledge and enabling increased adoption of Best Agricultural Practice, this project will boost the oil-palm (fresh fruit bunch) yields of >1000 smallholder households by an estimated 50-100% while simultaneously reducing reliance on agrochemicals (fertilizers and pesticides),

hence increasing net household incomes by 5,000-10,000GHC (£900-£1800) per annum by the end of the project. In addition, >10,000 people within rural communities, and especially women who typically tend to crops, will benefit from reduced exposure to agrochemicals and mitigation of soil erosion, surface runoff and risks of flash flooding, through improved soil management and better land-use planning. RSPO certification among an estimated 50% of smallholder households adopting BAP will then provide an additional premium for certified sustainable palm oil (CSPO) based on access to markets (e.g. the key palm-oil using sectors, NGOs and Government in the UK are aiming to source 100% of palm oil as CSPO by the end of 2015; DEFRA Annual Report). Hence smallholders' access to markets will be increasingly enhanced by certification as demand for CSPO continues to grow.

7. Project support to gender equality issues

Our project will directly train >1000 smallholders in rural Ghana in BAP methods, particularly benefiting women who traditionally carry out much of the work of cultivation including application of agrochemicals and harvesting of fruit. In addition, >10,000 people within rural communities, and especially women who typically tend to crops, will benefit from reduced exposure to agrochemicals and mitigation of soil erosion, surface runoff and risks of flash flooding, through improved soil management and better land-use planning. Our smallholder survey data (Annex 11) are stratified by gender, allowing us to examine socio-economic and logistical constraints on both women and men from realizing income benefits of increased FFB yields (logframe indicator 2.1). Our before-and-after surveys of smallholders participating in the Best Agricultural Practice experiment will also allow us to examine gender equality in scores for importance of and satisfaction with BAP (logframe indicator 3.1). Additionally, anonymised data obtained at smallholder knowledge dissemination and training events will allow us to examine gender equality in attendance and outcomes (logframe indicator 3.3).

8. Monitoring and evaluation

Covered in Section 2: M&E is carried out by Project Steering Committee; no changes to M&E plan over reporting period.

9. Lessons learnt

The project has benefited immensely from the expertise and input of our Ghanaian project partners, especially NCRC. This has highlighted the importance of a strong international partnership with very capable, experienced and highly committed partners in the host country. If repeating the project, we would take account from the outset of changes to Tier 4 UK Study Visa regulations for overseas students, which no longer permit part-time study in the UK.

10. Actions taken in response to previous reviews (if applicable)

N/A

11. Other comments on progress not covered elsewhere

The design of the project has been enhanced over the past year by refinements to our data collection and analysis. From experience on the ground we have recognized that in practice, there is a spectrum of crop management intensities within each of our two experimental treatments. Hence we have added to the environmental data collected from each study plot, allowing us to quantify relationships between crop management and different response variables much more precisely.

12. Sustainability and legacy

By helping to make smallholder oil-palm production more efficient and sustainable, this project will create a "win-win" for poverty reduction and biodiversity conservation and support the country under its CBD commitments. By quantifying for the first time how different agricultural practices boost yields, and disseminating this information widely through our project activities

and partner extension services, we will enable smallholders to make informed choices over the uptake of Best Agricultural Practice, thus removing one of the major impediments to improving smallholders' livelihoods.

The area of land cultivated by smallholders is likely to increase under Ghana's Poverty Reduction Strategy. Hence, by promoting practices that boost biodiversity within smallholdings and adjacent forest as well as increasing oil-palm yields, and by providing guidance and advice on effective land-use planning, we will minimize biodiversity losses resulting from any future expansion. By liaising with RSPO to facilitate the process of certification and assisting smallholders to form associations to apply for support with costs of certification, we will also ensure that high conservation value forest areas within these agricultural landscapes are fully protected from replacement by oil-palm, in adherence to RSPO Principles and Criteria for certification.

Our two Darwin Research Fellows, trained to MRes level in advanced statistics and experimental design, quantitative census methods, avian and insect identification and taxonomy, spatial modelling techniques and GIS, will continue to work for our project partners beyond the end of the project, ensuring that their skills and knowledge are retained and used in the long term to train others. Our permanent transects will also facilitate continued monitoring of longer-term biodiversity and soil quality benefits beyond the duration of the project.

The project has a growing profile among stakeholders in Ghana including smallholders, NGOs and the academic community. Effort during Yr1 has been aimed primarily at engaging with smallholder communities, setting up the BAP experiment and ensuring that the project is properly established, but we have also promoted the work more widely through seminars in the UK, the project website and a series of tweets coinciding with project milestones (see Sections 2 and 3). We have not made nor do we propose to make any changes to our planned exit strategy, as this is a discrete project that will reach a stable and sustainable end point.

13. Darwin identity

Our project has a clear identity and is recognized as a Darwin Initiative funded project. We have used the Darwin Initiative logo on all project documentation (e.g. annexes 8-10) and all project tweets have been tagged @Darwin_Defra (e.g. see Plate 2).

14. Project expenditure

Table 1: Project expenditure during the reporting period (1 April 2016 – 31 March 2017)

Project spend (indicative) since last annual report	2016/17 Grant (£)	2016/17 Total Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)			1.1	-
Consultancy costs	0	0	0	-
Overhead Costs			4.3	-
Travel and subsistence			15.0	The underspend in T&S and overspend in Operating Costs were simply due to different elements of fieldwork in Ghana being assigned to different categories (rental of fieldwork accommodation and use of 4x4 vehicles and drivers to OCs; all other expenditure

				to T&S). In practice, we made greater use of OCs and less use of T&S than expected, but the total expenditure on fieldwork (£26,444) was only 7% greater than expected (£24,700) despite a 20% decrease in the value of Sterling against other currencies.
Operating Costs			76.0	See Travel and subsistence above
Capital items (see below)			30.7	This expenditure was lower than expected because in practice it was not necessary to purchase new binoculars and digital sound recorders for bird censuses.
Others (see below)		0	100.0	Overseas students are no longer permitted to study part-time in the UK, following changes to Tier 4 UK Study Visa regulations. The two DRFs will now each register full-time for an MSc by Research at the University of Leeds, commencing October 2017. This change (moving student registration fees from Yr1 to Yr2) was approved following submission of a change request in December 2016 and highlighted in the Year 1 HYR.
TOTAL				

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2016-2017

Project summary	Measurable Indicators	Progress and Achievements April 2016 - March 2017	Actions required/planned for next period
<p>Impact</p> <p>Promotion of sustainable agriculture to improve rural livelihoods and protect biodiversity</p>		<p>Project is on schedule to deliver clear evidence-based policy guidance, advice and assistance to smallholders, promoting sustainable oil-palm cultivation that boosts smallholders' incomes, supports farmland biodiversity and ensures the long-term protection of high-diversity rainforest.</p>	
<p>Outcome</p> <p>Improved agricultural practices increase incomes of Ghanaian oil-palm smallholders, boost biodiversity within smallholdings and adjacent forest, promote sustainability certification by smallholders and ensure robust land-use planning to protect high-conservation-value rainforest.</p>	<p>0.1 Oil-palm (fresh fruit bunch) yields of focal smallholders using Best Agricultural Practice increase by 50-100%, from 3-5 tonnes ha⁻¹ year⁻¹ to 7-10 tonnes ha⁻¹ year⁻¹, increasing annual household incomes by an average of 5,000-10,000 GHC (£900-1800) by end of Yr2.</p> <p>0.2 Bird, butterfly, ant and termite biodiversity within smallholdings using Best Agricultural Practice and adjacent forest, including foraging success of focal bird species, increase by >10% in comparison to controls by end of Yr2.</p> <p>0.3 Evidence-base of economic benefits of Best Agricultural Practice disseminated to >1000 smallholders together with training in applying BAP, including robust and cost-effective identification and prioritisation of HCV forest for long-term protection, resulting in widespread adoption by Yr3.</p> <p>0.4 More than 500 smallholder farmers adopting BAP achieve RSPO</p>	<p>0.1 BAP experiment established and underway, including collection of data on smallholder yields and income in addition to environmental conditions (temperature, light, vegetation and soil) in control and treatment groups.</p> <p>0.2 Biodiversity surveys established and underway for birds, ants, termites and butterflies in BAP experimental plots and adjacent forest.</p> <p>0.3 Not due for delivery in Yr1.</p> <p>0.4 Not due for delivery in Yr1.</p>	<p>The following actions are planned for Yr2:</p> <p>Completion of data collection for BAP experiment.</p> <p>Commencement of data analysis and spatial modelling (due for completion in Yr3).</p> <p>Presentation of initial findings at RSPO roundtable meeting.</p>

	certification, including approval of plans for identifying and conserving HCV forest, by Yr3.		
Output 1. Two Darwin Research Fellows from project partner organizations trained to design and carry out field experiments and to analyse, interpret and report data obtained.	<p>1.1 DRFs successfully complete MRes modules in advanced statistics and experimental design, quantitative census methods, avian and insect identification and GIS.</p> <p>1.2 DRFs each write up two reports on data and findings arising from BAP experiment, which are up-loaded onto the RSPO website.</p> <p>1.3 DRFs are each awarded MRes degrees and co-author a minimum of four peer-reviewed open access publications quantifying the FFB yield, income and biodiversity benefits of improved agricultural practices.</p>	<p>1.1 Two DRFs were recruited to the project from partner organizations NCRC and KNUST at the start of the project (evidence provided in Section 3.1).</p> <p>1.2 Good progress on data collection (evidence provided in Section 3.1 and Annexes 5 to 13). Analysis and write-up scheduled for Yrs2-3.</p> <p>1.3 DRFs will each register full-time for an MSc by Research at the University of Leeds, commencing October 2017 (details provided in Section 3.1).</p>	
Activity 1.1 Two graduate Darwin Research Fellows (DRFs) recruited to project from partner organizations.		Two DRFs were recruited to the project from partner organizations NCRC and KNUST at the start of the project.	
Activity 1.2 DRFs visit UK for two periods of six months each, to take MRes modules at University of Leeds.		Following changes to Tier 4 UK Study Visa regulations, the two DRFs will now each register full-time for an MSc by Research at the University of Leeds, commencing October 2017 (further detail and explanation in Section 3.1).	
Activity 1.3 DRFs each complete two project dissertations reporting results of BAP field experiments, which contribute successfully to gaining sufficient credits for award of MRes degrees.		Following changes to Tier 4 UK Study Visa regulations, the two DRFs will now each register full-time for an MSc by Research at the University of Leeds, commencing October 2017 (further detail and explanation in Section 3.1).	
Output 2. Measurement and authentication of increases in Fresh Fruit Bunch yield, income and biodiversity resulting from Best Agricultural Practice, and of the usefulness of easily-obtained measures to identify HCV forest for land-use planning.	<p>2.1 Monthly records of oil-palm income (quantity of FFBs sold and price from mill) from control (current management) and experimental (Best Agricultural Practice) plots of 40 smallholders in BAP experiment, together with report on socio-economic and logistical constraints on both women and men from realizing income benefits of</p>	<p>2.1 Initial survey of >100 smallholders completed and BAP experiment established with ongoing collection of yield and income data of 40 smallholders (evidence provided in Section 3.1 and Annexes 5-13).</p> <p>2.2 Permanent study plots established in oil palm (BAP experimental plots, n = 80) and adjacent rain forest, with ongoing collection of environmental data (temperature, light, vegetation and soil) and biodiversity data and samples (birds, butterflies, ants and termites) in every plot (evidence provided in Section 3.1 and Annexes 5-13).</p>	

	<p>increased FFB yields.</p> <p>2.2 Permanent transects established and census data (species richness, abundance and composition) obtained for birds and insects in experimental and control plots of 40 smallholders in BAP experiment and adjacent forest plots. Additional census data on topographical and vegetation characteristics of study plots in forest. Database on foraging behaviour of focal bird species within oil-palm in experimental and control plots. Fully catalogued reference collections with online databases for new species.</p> <p>2.3 Published data quantifying the FFB yield, income and biodiversity benefits of Best Agricultural Practice for oil-palm smallholders in target communities, and the relationships between topographical and vegetation characteristics of forest and biodiversity.</p>	<p>2.3 Data collection is progressing as planned and on schedule (Section 3.1) with publications scheduled for project Yr3.</p>
<p>Activity 2.1. BAP experiment runs for 12 months; smallholders keep monthly records of FFB weights sold to mill and prices paid, and send data to DRFs by mobile phone texts (SMS).</p>		<p>The BAP experiment is on schedule for completion in project Yr2. In practice, obtaining data direct from smallholders has proven unreliable and so we are now employing a member of each smallholder community to weigh harvested fruit bunches and convey data to the DRFs.</p>
<p>Activity 2.2. Smallholder surveys to obtain data on crop management, socio-economic and environmental variables, including constraints on translating additional FFB yields into additional income, with particular focus on constraints imposed on women. Fieldwork to survey birds and insects in smallholdings and forest, and collect soil samples in smallholdings, at start and end of BAP experiment.</p>		<p>Surveys of >100 smallholders have been completed on schedule (evidence provided in Annex 11) and fieldwork is underway (evidence provided in Section 3.1 and Annex 12), scheduled for completion in Yr2.</p>
<p>Activity 2.3 Spatial modelling of key drivers of variation in FFB yields and incomes, and of the robustness and reliability of cost-effective measures to identify HCV forest; analysis of BAP experiment data, including laboratory analysis of soil quality, identification of insects, and verification of bird</p>		<p>These activities are scheduled for Yrs2-3.</p>

vocalizations.		
<p>Output 3. More than 1000 smallholder farmers, comprising men and women equally, have raised awareness of benefits and better knowledge of how to apply Best Agricultural Practice, including robust land-use planning to identify, prioritise and protect HCV forest.</p>	<p>3.1 Before-and-after surveys of smallholders participating in Best Agricultural Practice experiment show measured increases in scores for importance of and satisfaction with BAP, equally among women and men.</p> <p>3.2 >1000 smallholders attend knowledge dissemination and training events held within smallholder communities and with smallholder out-growers at oil-palm estates.</p> <p>3.3 Multiple-choice quizzes completed anonymously by smallholders at start and end of knowledge dissemination and training events show measured increases in average scores, equally among women and men.</p>	<p>Initial surveys of smallholders in BAP experiment have been completed on schedule (evidence provided in Annex 11). Other indicators are scheduled for Yrs2-3.</p>
<p>Activity 3.1 Organize 10 community-based BAP and land-use planning dissemination and training events, each for ~100 smallholders, supported by Handbook of Best Agricultural Practice and with assistance and input from participants in BAP experiment, who will be trained appropriately (i.e. training the trainers).</p>		<p>Scheduled for Yr3</p>
<p>Activity 3.2 Conduct surveys via questionnaires and multiple-choice quizzes to gauge attitudes and levels of knowledge and understanding of BAP, including identification and prioritisation of HCV forest for long-term protection, before and after each knowledge-dissemination and training event.</p>		<p>Scheduled for Yr3</p>
<p>Activity 3.3 Refine dissemination and training material based on feedback from events, and broadcast via means deemed most suitable by smallholders (social media, website, leaflets, pamphlets, posters, videos, etc).</p>		<p>Scheduled for Yr3</p>
<p>Output 4. More than 500 smallholder farmers form associations and support networks, receive assistance with costs of certification from RSPO and use this to apply successfully for certification.</p>	<p>4.1 Local smallholder associations and support networks share good practice and knowledge, linked by text messaging networks, social media sites or alternatives as preferred by each community.</p>	<p>Scheduled for Yr3</p>

	<p>4.2 Each smallholder association applies successfully for assistance from RSPO's Smallholders Support Fund (RSSF), assisted by community-based certification events and supported by a handbook on achieving RSPO-certification.</p> <p>4.3 Aided by RSSF and with continued support from project partners, each smallholder association applies successfully for RSPO-certification.</p>	
Activity 4.1 Organize 10 community-based certification events, each for ~100 smallholders and supported by a Handbook on Achieving RSPO-Certification, giving guidance on forming Smallholder Associations and support networks, and on applying together to RSSF for assistance with costs of certification.		Scheduled for Yr3
Activity 4.2 Monitor RSSF applications and provide feedback and assistance where needed to ensure successful outcomes.		Scheduled for Yr3
Activity 4.3 Organize community visits and use newly-established support networks to assist Smallholder Associations in receipt of RSSF funding to successfully complete process of RSPO certification.		Scheduled for Yr3
<p>Output 5. Evidence and lessons learned from project disseminated to policy makers in Ghana and internationally.</p>	<p>5.1 Fact sheets and policy recommendations submitted to Ghanaian government (Ministry of Food and Agriculture; Ministry of Environment, Science, Technology and Innovation) and equivalent ministries in neighbouring countries committed to rapid expansion of oil-palm cultivation.</p> <p>5.2 Powerpoint presentations to ~ 1000 delegates at each of two annual RSPO Roundtable meetings.</p> <p>5.3 Ministry of Food and Agriculture in Ghana and equivalents in neighbouring countries discuss with project partners how best to further disseminate project findings and facilitate RSPO</p>	Scheduled for Yrs2-3

	certification in other communities in Ghana and other West African countries.	
Activity 5.1 Meeting with Ministry of Food and Agriculture in Ghana to present fact sheets and policy recommendations arising from project.		Scheduled for Yr3
Activity 5.2 Dissemination of material to other government ministries, universities and environmental NGOs operating in region, including through end of project workshop.		Scheduled for Yr3
Activity 5.3 Presentations to RSPO Roundtable Meetings in 2018 (RT15) and 2019 (RT16).		Scheduled for Yr2 and Yr3

Annex 2: Project’s full current logframe as presented in the application form

PROJECT MONITORING AND EVALUATION MEASURING IMPACT

23. LOGICAL FRAMEWORK

Darwin projects will be required to report against their progress towards their expected outputs and outcomes if funded. This section sets out the expected outputs and outcomes of your project, how you expect to measure progress against these and how we can verify this.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: Promotion of sustainable agriculture to improve rural livelihoods and protect biodiversity. (Max 30 words)			
Outcome: Improved agricultural practices increase incomes of Ghanaian oil-palm smallholders, boost biodiversity within smallholdings and adjacent forest, promote sustainability certification by smallholders and ensure robust land-use planning to protect high-conservation-value rainforest. (Max 30 words)	<p>0.1 Oil-palm (fresh fruit bunch) yields of focal smallholders using Best Agricultural Practice increase by 50-100%, from 3-5 tonnes ha⁻¹ year⁻¹ to 7-10 tonnes ha⁻¹ year⁻¹, increasing annual household incomes by an average of 5,000-10,000 GHC (£900-1800) by end of Yr2.</p> <p>0.2 Bird, butterfly, ant and termite biodiversity within smallholdings using Best Agricultural Practice and adjacent forest, including foraging success of focal bird species, increase by >10% in comparison to controls by end of Yr2.</p> <p>0.3 Evidence-base of economic benefits of Best Agricultural Practice disseminated to >1000 smallholders together with training in applying BAP, including robust and cost-effective identification and</p>	<p>0.1 Two technical reports and two peer-reviewed publications on key drivers of variation in oil-palm yields and incomes, and on impacts of Best Agricultural Practice on yields and incomes from BAP experiment.</p> <p>0.2 Two technical reports and two peer-reviewed publications on impacts of Best Agricultural Practice on bird and insect biodiversity from BAP experiment, and on the robustness and reliability of cost-effective measurements of forest characteristics to identify and prioritise HCV forest for long-term protection.</p> <p>0.3 Material for use at smallholder knowledge-dissemination, training and certification events; report on outcomes of events including smallholder surveys, questionnaires</p>	<p>1. Current oil-palm fresh fruit bunch (FFB) yields are below maximum and can be substantially increased. Discussions with our project partners indicate that average yields are currently below half those achieved on industrial plantations in the region, and that this is largely the result of poor agricultural practices of smallholders.</p> <p>2. There is access to markets for additional oil-palm yields. The rapid and sustained increased in global demand for certified palm oil indicates this is very likely.</p> <p>3. Current levels of bird and insect biodiversity in smallholdings and adjacent forest can be enhanced by BAP. Available evidence indicates this is the case for other crops (e.g. coffee, cocoa) and hence is likely to</p>

	<p>prioritisation of HCV forest for long-term protection, resulting in widespread adoption by Yr 3.</p> <p>0.4 More than 500 smallholder farmers adopting BAP achieve RSPO certification, including approval of plans for identifying and conserving HCV forest, by Yr 3.</p>	<p>and multiple-choice quizzes.</p> <p>0.4 Data on applications by Smallholder Associations for RSPO-certification, success rates of applications, and price premiums paid to certified growers provided by project partners RSPO and Solidaridad.</p>	<p>also be the case for oil-palm.</p> <p>4. Adoption of BAP will enable smallholders to achieve RSPO certification. We will work closely with smallholder communities, palm oil estates wishing to get their smallholder out-growers certified and RSPO agencies to facilitate this process, drawing extensively on the considerable expertise and successful experience of our project partners at Solidaridad, and making full use of RSPO funds (their Smallholder Support Fund, RSSF,) specifically for this purpose.</p> <p>5. Smallholders adopting BAP will not subsequently increase the area under cultivation at the expense of high-conservation-value rainforest. In practice, the area of land given over to oil-palm cultivation by smallholders is set for a large increase under Ghana's Poverty Reduction Strategy, and so promoting effective land-use planning as a key component of BAP for both established smallholdings and new plantings is more important than ever. RSPO certification will ensure that high conservation value forest within areas designated for expansion is fully protected from replacement by oil-palm, whereas it is currently highly vulnerable.</p>
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<p>Outputs:</p> <p>1. Two Darwin Research Fellows from project partner organizations trained to design and carry out field experiments and to analyse, interpret and report data obtained.</p>	<p>1.1 DRFs successfully complete MRes modules in advanced statistics and experimental design, quantitative census methods, avian and insect identification and GIS.</p> <p>1.2 DRFs each write up two reports on data and findings arising from BAP experiment, which are uploaded onto the RSPO website.</p> <p>1.3 DRFs are each awarded MRes degrees and co-author a minimum of four peer-reviewed open access publications quantifying the FFB yield, income and biodiversity benefits of improved agricultural practices.</p>	<p>1.1 Transcripts and marks for module assessments, approved by MRes exam board.</p> <p>1.2 Four reports uploaded to RSPO website.</p> <p>1.3 MRes degree certificates and classifications (Pass, Merit or Distinction). Papers published in peer-reviewed journals and freely accessible via the White-Rose Open Access repository of scientific papers.</p>	<p>DRFs and smallholders can be recruited to the project and remain active and fully committed to its aims and objectives. This will be greatly enhanced by the strong links between project partners and the extensive experience and expertise of Ghanaian partners in working with rural farming communities.</p>
<p>2. Measurement and authentication of increases in Fresh Fruit Bunch yield, income and biodiversity resulting from Best Agricultural Practice, and of the usefulness of easily-obtained measures to identify HCV forest for land-use planning.</p>	<p>2.1 Monthly records of oil-palm income (quantity of FFBs sold and price from mill) from control (current management) and experimental (Best Agricultural Practice) plots of 40 smallholders in BAP experiment, together with report on socio-economic and logistical constraints on both women and men from realizing income benefits of increased FFB yields.</p> <p>2.2 Permanent transects established and census data (species richness, abundance and composition) obtained for birds and insects in experimental and control plots of 40 smallholders in BAP experiment and adjacent forest plots. Additional</p>	<p>2.1 Excel Workbook with spreadsheets of monthly records; report uploaded to project website.</p> <p>2.2 Database of results of BAP experiment including bird and insect records published and freely accessible via project website and Global Biodiversity Information Facility. Insect reference collections deposited at KNUST, with full descriptions, images and accession numbers of new species in global online databases.</p> <p>2.3 Papers published in peer-reviewed journals and freely accessible via the White-Rose Open Access repository of scientific papers, with supporting data</p>	<p>BAP experiment will yield clear results showing publishable benefits of BAP for biodiversity. Our previous research elsewhere supports the notion that birds and insects respond quickly and are sensitive to habitat improvements.</p>

	<p>census data on topographical and vegetation characteristics of study plots in forest. Database on foraging behaviour of focal bird species within oil-palm in experimental and control plots. Fully catalogued reference collections with online databases for new species.</p> <p>2.3 Published data quantifying the FFB yield, income and biodiversity benefits of Best Agricultural Practice for oil-palm smallholders in target communities, and the relationships between topographical and vegetation characteristics of forest and biodiversity.</p>	<p>deposited in a freely-available data repository (e.g. Dryad).</p>	
<p>3. More than 1000 smallholder farmers, comprising men and women equally, have raised awareness of benefits and better knowledge of how to apply Best Agricultural Practice, including robust land-use planning to identify, prioritise and protect HCV forest.</p>	<p>3.1 Before-and-after surveys of smallholders participating in Best Agricultural Practice experiment show measured increases in scores for importance of and satisfaction with BAP, equally among women and men.</p> <p>3.2 >1000 smallholders attend knowledge dissemination and training events held within smallholder communities and with smallholder out-growers at oil-palm estates.</p> <p>3.3 Multiple-choice quizzes completed anonymously by smallholders at start and end of knowledge dissemination and training events show measured</p>	<p>3.1 Anonymised results of before-and-after surveys, stratified by gender, uploaded to project website with accompanying report summarising analysis and findings.</p> <p>3.2 National and social media coverage of smallholder knowledge-dissemination and training events, plus written material used at these events uploaded to project website.</p> <p>3.3 Results of questionnaires and multiple-choice assessments of training outcomes at these events, with reports, uploaded to project website.</p>	<p>>1000 smallholders, comprising men and women equally, will attend knowledge dissemination and training events, and complete anonymised multiple choice assessments. Our project partners' extensive experience of working with rural farming communities in Ghana strongly suggests that this will be the case.</p>

	increases in average scores, equally among women and men.		
4. More than 500 smallholder farmers form associations and support networks, receive assistance with costs of certification from RSPO and use this to apply successfully for certification.	<p>4.1 Local smallholder associations and support networks share good practice and knowledge, linked by text messaging networks, social media sites or alternatives as preferred by each community.</p> <p>4.2 Each smallholder association applies successfully for assistance from RSPO's Smallholders Support Fund (RSSF), assisted by community-based certification events and supported by a handbook on achieving RSPO-certification.</p> <p>4.3 Aided by RSSF and with continued support from project partners, each smallholder association applies successfully for RSPO-certification.</p>	<p>4.1 Facebook pages, twitter accounts and tweets, or alternatives as preferred by each community.</p> <p>4.2 Material used at certification events, including handbook on achieving certification, uploaded to project website. Annual reports from RSPO on numbers and outcomes of applications by Smallholder Associations and estates for RSSF assistance with costs of certification.</p> <p>4.3 Annual reports from RSPO on numbers and outcomes of subsequent applications to become RSPO-certified.</p>	Smallholders wish to achieve certification for sustainability. Evidence from RSPO shows strong support from smallholders elsewhere, and enthusiastic uptake of RSSF support once benefits of certification are evident.
5. Evidence and lessons learned from project disseminated to policy makers in Ghana and internationally.	<p>5.1 Fact sheets and policy recommendations submitted to Ghanaian government (Ministry of Food and Agriculture; Ministry of Environment, Science, Technology and Innovation) and equivalent ministries in neighbouring countries committed to rapid expansion of oil-palm cultivation.</p> <p>5.2 Powerpoint presentations to ~ 1000 delegates at each of two annual RSPO Roundtable meetings.</p> <p>5.3 Ministry of Food and Agriculture</p>	<p>5.1 Fact sheets and policy documents, with records of dissemination to government ministries, universities, environmental NGOs and RSPO Roundtable meetings.</p> <p>5.2 Roundtable programmes and proceedings; Powerpoint presentations uploaded to RSPO and project websites.</p> <p>5.3 Minutes and Action Points arising from discussion meetings.</p>	Government agencies in Ghana and neighbouring countries recognize the importance of smallholders for oil-palm production and the value of promoting sustainable cultivation that improves rural livelihoods. CBD reports and Poverty Reduction Strategy Papers of different countries strongly indicate that this is the case.

	<p>in Ghana and equivalents in neighbouring countries discuss with project partners how best to further disseminate project findings and facilitate RSPO certification in other communities in Ghana and other West African countries.</p>		
<p>Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)</p> <p>1.1 Two graduate Darwin Research Fellows (DRFs) recruited to project from partner organizations.</p> <p>1.2 DRFs visit UK for two periods of six months each, to take MRes modules at University of Leeds.</p> <p>1.3 DRFs each complete two project dissertations reporting results of BAP field experiments, which contribute successfully to gaining sufficient credits for award of MRes degrees.</p> <p>2.1 BAP experiment runs for 12 months; smallholders keep monthly records of FFB weights sold to mill and prices paid, and send data to DRFs by mobile phone texts (SMS).</p> <p>2.2 Smallholder surveys to obtain data on crop management, socio-economic and environmental variables, including constraints on translating additional FFB yields into additional income, with particular focus on constraints imposed on women. Fieldwork to survey birds and insects in smallholdings and forest, and collect soil samples in smallholdings, at start and end of BAP experiment.</p> <p>2.3 Spatial modelling of key drivers of variation in FFB yields and incomes, and of the robustness and reliability of cost-effective measures to identify HCV forest; analysis of BAP experiment data, including laboratory analysis of soil quality, identification of insects, and verification of bird vocalizations.</p> <p>3.1 Organize 10 community-based BAP and land-use planning dissemination and training events, each for ~100 smallholders, supported by Handbook of Best Agricultural Practice and with assistance and input from participants in BAP experiment, who will be trained appropriately (i.e. training the trainers).</p> <p>3.2 Conduct surveys via questionnaires and multiple-choice quizzes to gauge attitudes and levels of knowledge and understanding of BAP, including identification and prioritisation of HCV forest for long-term protection, before and after each knowledge-dissemination and training event.</p> <p>3.3 Refine dissemination and training material based on feedback from events, and broadcast via means deemed most suitable by smallholders (social media, website, leaflets, pamphlets, posters, videos, etc).</p> <p>4.1 Organize 10 community-based certification events, each for ~100 smallholders and supported by a Handbook on Achieving RSPO-Certification, giving guidance on forming Smallholder Associations and support networks, and on applying together to RSSF for assistance with costs of certification.</p> <p>4.2 Monitor RSSF applications and provide feedback and assistance where needed to ensure successful outcomes.</p> <p>4.3 Organize community visits and use newly-established support networks to assist Smallholder Associations in receipt of RSSF funding to successfully complete process of RSPO certification.</p> <p>5.1 Meeting with Ministry of Food and Agriculture in Ghana to present fact sheets and policy recommendations arising from project.</p> <p>5.2 Dissemination of material to other government ministries, universities and environmental NGOs operating in region, including through end of project workshop.</p> <p>5.3 Presentations to RSPO Roundtable Meetings in 2018 (RT15) and 2019 (RT16).</p>			

Annex 3: Standard Measures

Table 1 Project Standard Output Measures

Code No.	Description	Gender of people (if relevant)	Nationality of people (if relevant)	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
Established codes								
2	Number of people to obtain Masters qualification	One male, one female	Both Ghanaian			2		2
7	Manual of Best Agricultural Practice and Handbook on RSPO Certification					2		2
9	Science-for-Policy reports					4		4
11	Papers in peer-reviewed journals					4		4
12A	Databases of bird, butterfly, moth, ant and termite data					5		5
12B	Global online database of newly-identified ant species					1		1
13A	Reference collections of butterflies, moths, ants and termites					4		4
14A	Smallholder knowledge-dissemination and training workshops					10		10
14B	Conference and seminar presentations				2	4		6
20	Computers, loggers, sampling equipment, etc			£3000	£2000		£3000	£5000
22	Permanent field plots			100			100	100

Table 2 Publications

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)
None in Yr1						

Annex 4; Signed Academic Partnership Agreement
Separate document (PDF)



University Research Ethics Committee - application for ethical review

Please email your completed application form along with any relevant supporting documents to ResearchEthics@leeds.ac.uk (or to FMHUniEthics@leeds.ac.uk if you are based in the Faculty of Medicine and Health) at least 6 weeks before the research/ fieldwork is due to start. Dentistry and Psychology applicants should follow their School's procedures for submitting an application.

Ethics reference (leave blank if unknown)	Student number (if a student application)	Grant reference (if externally funded)	Module code (if applicable)

Faculty or School Research Ethics Committee to review the application (put a 'X' next to your choice)		Arts and PVAC (PVAR)
	X	Biological Science (BIOSCI)
		ESSL, Environment and LUBS (AREA)
		MaPS and Engineering (MEEC)
		School of Dentistry (DREC)
		School of Healthcare (SHREC)
		School of Medicine (SoMREC)
		School of Psychology (SoPREC)

Indicate what type of ethical review you are applying for:		Student project (PhD, Masters or Undergraduate)
	X	Staff project (externally or internally funded)

Section 1: Basic project details			
1.1 Research title	Impacts of Crop Management on Smallholder Oil Palm Yields and Biodiversity		
1.2 Research start date (dd/mm/yy)	Proposed fieldwork start date (dd/mm/yy)	Proposed fieldwork end date (dd/mm/yy)	Research end date (dd/mm/yy)
01/04/16	01/10/16	30/09/18	31/03/19
Yes	No		
✓		1.3 I confirm that I have read and understood the current version of the University of Leeds Research Ethics Policy. <i>The Policy is available at http://ris.leeds.ac.uk/ResearchEthicsPolicies.</i>	
✓		1.4 I confirm that I have read and understood the current version of the University of Leeds Research Data Management Policy. <i>The policy is available at http://library.leeds.ac.uk/research-data-management-policy.</i>	
✓		1.5 I confirm that I have read and understood the current version of the University of Leeds Information Protection Policy. <i>The policy is available at http://it.leeds.ac.uk/info/116/policies/249/information_protection_policy</i>	

✓	1.6 I confirm that NHS ethical review is not required for this project. <i>Refer to http://ris.leeds.ac.uk/NHSEthicalreview for guidance in identifying circumstances which require NHS review</i>
✓	1.7 Will the research involve NHS staff recruited as potential research participants (by virtue of their professional role) or NHS premises/ facilities? <i>Please note: If yes, NHS R&D management permission or local management permission may also be needed. Refer to http://ris.leeds.ac.uk/NHSEthicalreview.</i>

Section 2: Contact details	
2.1 Name of applicant	Professor Keith Hamer
2.2 Position (eg PI, Co-I, RA, student)	PI
2.3 Department/ School	Biology
2.4 Faculty	Biological Sciences
2.5 Work address (usually at the University of Leeds)	Irene Manton Building
2.6 Telephone number	0113 343 2983
2.7 University of Leeds email address	k.c.hamer@leeds.ac.uk

Section 3: Summary of the research
<p>3.1 In plain English provide a brief summary of the aims and objectives of the research. (max 300 words). The summary should briefly describe</p> <ul style="list-style-type: none"> • the background to the research and why it is important, • the questions it will answer and potential benefits, • the study design and what is involved for participants. <p><i>Your answers should be easily understood by someone who is not experienced in the field you are researching, (eg a member of the public) - otherwise it may be returned to you. Where technical terms are used they should be explained. Any acronyms not generally known should be described in full.</i></p> <p>Palm oil is a globally important edible oil that governments in western Africa are increasingly targeting as a key sector for agricultural growth and to address rural poverty. Most oil-palm growers in the region are smallholder farmers who rely on cultivation for both income and household consumption. For instance in Ghana, ~90% of the land cultivated for oil-palm (~400,000ha) comprises smallholdings. Ghana plans to expand smallholdings by a further 150,000ha over the next 5-10 years, making it vital to provide smallholders with tools and guidance to help them develop sustainable agricultural practices that optimise economic returns and reduce environmental threats; hence the need for this project.</p> <p>Growing markets in sustainably-sourced palm oil provide ideal opportunities for smallholders in Ghana to boost their incomes through take-up of best agricultural practice (BAP) to increase yields and reduce economic and environmental costs of reliance on fertilizers and pesticides. However, smallholder uptake of BAP is very low, and the reasons for this poor uptake are currently unclear. Hence an integral part of this project will be a survey of smallholder communities to assess the drivers and constraints of variation in adoption of BAP and to quantify the relationship between adoption of BAP and crop yields. An additional component of the work will be to survey birds, butterflies, ants and termites on selected smallholdings differing in agricultural practice, to assess potential co-benefits of BAP for biodiversity.</p>

3.2 Where will the research be undertaken?	In smallholder oil palm farming communities around Assin Fosu, in the High Forest Zone of Ghana
3.3 Who is funding the research?	DEFRA/DFID Darwin Initiative
<p><i>NB: If this research will be financially supported by the US Department of Health and Human Services or any of its divisions, agencies or programmes please ensure the additional funder requirements are complied with. Further guidance is available at http://iris.leeds.ac.uk/FWAcompliance and you may also contact your FRIO for advice.</i></p>	

Section 4: Research data and impact	
<p>You may find the following guidance helpful:</p> <ul style="list-style-type: none"> • Research data management guidance • Advice on planning your research project • Dealing with issues relating to confidentiality and anonymisation • Funder requirements and University of Leeds Research Data Management Policy 	
4.1 What is the data source? (Indicate with an 'X' all that apply)	
X	New data collected for this research
	Data previously collected for other research
	Data previously collected for non-research purposes
	Data already in the public domain
	Other, please state: _____.
4.2 How will the data be collected? (Indicate with an 'X')	
X	Through one-to-one research interviews
	Through focus groups
	Self-completion (eg questionnaires, diaries)
	Through observation
	Through autoethnographic research
	Through experiments/ user-testing involving participants
	From external research collaborators
	Other, please state: _____.
4.3 How will you make your research data available to others in line with: the University's, funding bodies' and publishers' policies on making the results of publically funded research publically available (in compliance with UK data protection legislation)? (max 200 words)	
<p>All peer-reviewed publications arising from the project will be made freely available (green open access route) via Leeds University's White-Rose repository, with supporting data deposited in a freely-available data repository (e.g. Dryad). Other data arising from the project will be shared in accessible formats via the Global Biodiversity Information Facility (http://www.gbif.org/) and the project website. Illustrated handbooks on Best Agricultural Practice and on Achieving RSPO Certification will be shared with smallholders attending dissemination and training events held within local communities, distributed to government ministries and environmental NGOs in the region and made freely available via the project website. Project staff will present results to development partners such as government ministries, NGOs and universities at an end of project workshop, and will also disseminate project findings more widely at annual RSPO Roundtable conferences.</p>	

4.4 How do you intend to share the research data, both within and outside the research team? (Indicate with an 'X')	
X	Depositing in a specialist data centre or archive
X	Submitting to a journal to support a publication
X	Depositing in a self-archiving system or an institutional repository
X	Dissemination via a project or institutional website
	Informal peer-to-peer exchange
	No plans to report or disseminate the data
	Other, please state: We will share data and results outside the research team through meetings with oil palm stakeholders and policy makers (sector stakeholder workshops).
4.5 How do you intend to report and disseminate the results of the study? (Indicate with an 'X')	
X	Peer reviewed journals
X	Internal report
X	Conference presentation
X	Publication on website
	Other publication
X	Submission to regulatory authorities
	No plans to report or disseminate the results
	Other, please state: _____.
4.6 Give details of the expected impact of the research. Further guidance is available at http://www.rcuk.ac.uk/innovation/impacts . (max 200 words)	
<p>This project will improve the scientific understanding and take-up of Best Agricultural Practice for oil-palm smallholders, boosting crop yields by an estimated 50% and hence increasing household incomes by ~5,000GHC (£1000) annually, while increasing biodiversity within smallholdings and adjacent forest, and promoting robust land-use planning that ensures the protection of high-conservation-value (HCV) forest throughout the planned expansion of oil-palm cultivation by smallholders. It will also directly train >1000 smallholders in rural Ghana in BAP methods, particularly benefiting women who traditionally carry out much of the work of cultivation including application of agrochemicals and harvesting of fruit. Each smallholder financially supports 6 family members on average, creating an additional 6000+ indirect beneficiaries. Adoption of BAP also provides additional potential benefits through RSPO certification, which we will promote through knowledge-exchange activities and networks, including through the RSPO. Ghana's 4th CBD Report recognises that increased cultivation of cash crops is threatening ecosystems. By making palm oil production more efficient and sustainable, this project will create a "win-win" for poverty reduction and biodiversity conservation, supporting the country under its CBD commitments (e.g. Aichi targets 1, 4, 7, 8, 11, 14, 19).</p>	

Section 5: Protocols		
Which protocols will be complied with? (Indicate with an 'X'). There may be circumstances where it makes sense not to comply	X	Data protection, anonymisation and storage and sharing of research data
	X	Informed consent
	X	Verbal consent
	X	Reimbursement of research participants

with a protocol, this is fine but should be clarified in your application.	X	Low risk observation
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Section 6: Additional ethical issues

6.1 Indicate with an 'X' in the left-hand column whether the research involves any of the following:

	Discussion of sensitive topics, or topics that could be considered sensitive
	Prolonged or frequent participant involvement
	Potential for adverse environmental impact
	The possibility of harm to participants or others (including the researcher(s))
	Participants taking part in the research without their knowledge and consent (eg covert observation of people in non-public places)
	The use of drugs, placebos or invasive, intrusive or potentially harmful procedures of any kind
	Food substances or drinks being given to participants (other than refreshments)
	Vitamins or any related substances being given to participants
	Acellular blood, urine or tissue samples obtained from participants (ie no NHS requirement)
	Members of the public in a research capacity (participant research)
	Participants who are particularly vulnerable (eg children, people with learning disabilities, offenders)
	People who are unable to give their own informed consent
	Researcher(s) in a position of authority over participants, eg as employers, lecturers, teachers or family members
	Financial inducements (other than reasonable expenses and compensation for time) being offered to participants
	Cooperation of an intermediary to gain access to research participants or material (eg head teachers, prison governors, chief executives)
	Potential conflicts of interest
	Internet participants or other visual/ vocal methods where participants may be identified
	Scope for incidental findings, ie unplanned additional findings or concerns for the safety or wellbeing of participants.
	The sharing of data or confidential information beyond the initial consent given
X	Translators or interpreters
X	Research conducted outside the UK
X	An international collaborator
	The transfer of data outside the European Economic Area
	Third parties collecting data
	Other ethical clearances or permissions

6.2 For the ethical issues indicated in 6.1 provide details of any additional ethical issues the research may involve and explain how these issues will be addressed. (max 200 words)

Smallholders have good English language skills (high-school education is conducted in English) but usually prefer to communicate in Ghanaian. Our research team includes three local project partners and two Darwin Research Fellows (one male, one female) who are bilingual (fluent in written and spoken English and Ghanaian) and will liaise with smallholder communities and conduct interviews. Our project partners in Ghana all have a strong international presence and excellent track-records of successful international collaborations, particularly with partners in the UK.

Section 7: Recruitment and consent process

For guidance refer to <http://ris.leeds.ac.uk/InvolvingResearchParticipants> and the [research ethics protocols](#).

7.1 State approximately how much data and/ or how many participants are going to be involved.

The initial survey of agricultural practices and yields will include ca 100 smallholders, from which 40 will be selected for subsequent biodiversity censuses. Each smallholder will be asked a standardized set of ca 40 questions relating to personal circumstances, farm characteristics, crop management and yields. Biodiversity data will be collected using point-counts (birds), baited traps (butterflies; these will be identified, marked and released in situ), pitfall traps (ants) and manual sorting of soil samples in situ (termites). This will involve visiting each selected smallholding for ca 30 mins on six consecutive days on two occasions ca six months apart (in wet and dry seasons).

7.2 How was that number of participants decided upon? (max 200 words)

Please note: The number of participants should be sufficient to achieve worthwhile results but should not be so high as to involve unnecessary recruitment and burdens for participants. This is especially pertinent in research which involves an element of risk. Describe here how many participants will be recruited, and whether this will be enough to answer the research question. If you have received formal statistical advice then please indicate so here, and describe that advice.

An initial sample of ca 100 farms is required to provide a sound basis to analyse impacts of crop management on yields; data will be analysed using general linear models including multiple covariates, and so this sample size is needed to provide sufficient degrees of freedom and statistical power. We will then use a subset of 40 farms for analysis of biodiversity. Given the anticipated effect size ($\Delta = 10\%$), this will be sufficient but not excessive to reveal a significant effect of crop management (estimated sample size for a Type I error rate of 5% = 36, based on the formula $n = 2(Z_{\alpha} + Z_{1-\beta})^2 \sigma^2 / \Delta^2$ where σ is the standard deviation of each mean).

7.3 How are the participants and/ or data going to be selected? List the inclusion and exclusion criteria. (max 200 words)

Our Ghanaian project partners have strong, well-established links and excellent working relationships with two smallholder farming communities in our study area. Each community has already elected a President, Vice-president, Secretary, Deputy Secretary and women's and youth representatives. Through them, we organized a village meeting in each community in July 2016, at which we explained our project and proposed methods, and answered questions from the community. Both meetings were well attended and well received, with attendees expressing enthusiasm to participate in a study of this type. Attendees were asked to inform each Secretary if, after a period of reflection, they still wished to participate. Secretaries and other community representatives also agreed to inform those smallholders unable to attend the meeting of this process. The only criterion for inclusion or exclusion of smallholders expressing willingness to participate will be whether or not they grow oil palm on their smallholdings, and we anticipate being able to include all such smallholders in our initial sample. Moreover there will be no benefits or harms to smallholders arising from inclusion or exclusion.

7.4 For each type of methodology, describe the process by which you will obtain and document freely given informed consent for the collection, use and reuse of the research data. Explain the storage arrangements for the signed consent forms.

Guidance is available at <http://ris.leeds.ac.uk/InvolvingResearchParticipants>. The relevant documents (information sheet and consent form) need to be attached to the end of this application. If you are not using an information sheet and/ or seeking written consent, please provide an explanation.

The questionnaire form used to obtain data will be accompanied by an information sheet explaining the purpose of the project and the questionnaire, and by a consent form which will be signed by each participant and by one or other of the project's two Community Liaison personnel (both Ghanaian; one male, one female) before completing the questionnaire. Completed forms will be stored securely in Ghana at the offices of our project partners NCRC.

7.5 Describe the arrangements for withdrawal from participation and withdrawal of data/ tissue. *Please note: It should be made clear to participants in advance if there is a point after which they will not be able to withdraw their data. See also <http://ris.leeds.ac.uk/ResearchDataManagement>. (max 200 words)*

Participants will be able to inform one or other of the project's two community liaison personnel (Darwin Researchers Fellows) or their local community representatives at any time if they wish to withdraw from the project and so not take part in the survey or not have biodiversity assessments on their smallholding. Completed survey forms will then be destroyed. However, once data have been anonymized they will not be removed from the spreadsheet, and this will be made clear on the project consent form.

7.6 Provide details of any incentives you are going to use and explain their purpose. (max 200 words)

Please note: Payment of participants should be ethically justified. The FREC will wish to be reassured that research participants are not being paid for taking risks or that payments are set at a level which would unduly influence participants. A clear statement should be included in the participant information sheet setting out the position on reimbursement of any expense incurred.

The main incentive is that data gathered by the project will be used to provide clear, objective and quantitative evidence to participants on the size of benefit of adopting BAP, in terms of increases in crop yields. No other incentive will be offered although in keeping with local custom, participants will be paid a small 'appreciation' (equivalent to ca £5) at the end of the project in recognition of their time and inconvenience.

Section 8: Data protection, confidentiality and anonymisation

Guidance is available at <http://ris.leeds.ac.uk/ConfidentialityAnonymisation>

8.1 How identifiable will the participants be? (Indicate with an 'X').

	Fully identifiable
X	Identity of subject protected by code numbers/ pseudonyms
	Fully anonymised
	Anonymised but potentially identifiable
	Data only in aggregated form
	Other

8.2 Describe the measures you will take to deal with issues of confidentiality, including any limits to confidentiality. (max 300 words)

<p>Information requested on the smallholder questionnaires will be restricted to that strictly required for the project, either to select smallholdings for biodiversity surveys or to use as descriptor or response variables in the project's socio-economic data analysis. Wherever possible, personal data will be collected using ranges rather than absolute values (e.g. smallholder's ages in 10-year categories). Hence the only unique attribute of any smallholder in the project database will be a randomly-allocated three-digital number (see 8.3 below).</p>
<p>8.3 Describe the measures you will take to deal with issues of anonymity. (max 200 words)</p>
<p>Smallholdings need to be individually identifiable in order to select sites for biodiversity surveys and to match biodiversity data to characteristics of each smallholding. Hence we need to record the GPS location of each smallholding, to ensure that we can locate biodiversity surveys correctly. However, this information will be retained only on the original smallholder questionnaire forms, which will be stored securely by our project partner NCRC and seen only by the Project Manager and the two research staff carrying out the smallholder and biodiversity surveys. Each participating smallholder will be randomly assigned a three-digit number and data from completed forms, excluding GPS co-ordinates, will be transferred to an Excel spreadsheet with smallholders identified only by number. The identity of the smallholder assigned each number will also be recorded (hardcopy only) so that we can contact them whenever necessary (for instance for payment of the 'appreciation' at the end of the project; see 7.6 above) but this information will be securely stored separately, and smallholders' names will not be included on the original questionnaire sheets.</p>
<p>8.4 Who will have access to the research data apart from the research team (eg translators, authorities)? (max 100 words)</p>
<p>No-one other than regulatory authorities as indicated on the project consent form, and they will have access to only the Excel spreadsheet of anonymised data.</p>
<p>8.5 Describe the process you will use to ensure the compliance of third parties with ethical standards. (max 100 words)</p>
<p>Our project partners have an excellent track-record of applying high ethical standards in projects of this type (e.g. recently-completed NERC ESPA project on cocoa) and are committed to maintaining the same high standards in this project. Compliance with ethical standards is a standing order on the agenda of project Steering Committee meetings and hence will be explicitly addressed every three months throughout the project.</p>
<p>8.6 Where and in what format(s) will research data, consent forms and administrative records be retained? (max 200 words)</p> <p><i>Please note: Mention hard copies as well as electronic data. Electronic data should be stored securely and appropriately and in accordance with the University of Leeds Data Protection Policy available at http://www.leeds.ac.uk/secretariat/data_protection_code_of_practice.html.</i></p>
<p>Hard copies of data and consent forms will be stored securely at the offices of NCRC in Ghana. All electronic data (Excel spreadsheet) will be anonymized and will not contain any identifiable personal data.</p>
<p>8.7 If online surveys are to be used, where will the responses be stored? (max 200 words)</p> <p>Refer to: http://it.leeds.ac.uk/info/173/database_and_subscription_services/206/bristol_online_survey_accounts and http://ris.leeds.ac.uk/SecuringResearchData for guidance.</p>
<p>No online surveys will be used.</p>

8.8 Give details and outline the measures you will take to assess and to mitigate any foreseeable risks (other than those already mentioned) to the participants, the researchers, the University of Leeds or anyone else involved in the research? (max 300 words)

The research proposal has undergone competitive peer review and been independently assessed for ODA-compliance on behalf of DFID, achieving a high score (A-).

Section 9: Other ethical issues

Yes	No	(Indicate with an 'X')
X		9.1 Is a health and safety risk assessment required for the project? <i>Please note: Risk assessments are a University requirement for all fieldwork taking place off campus. The risk assessment forms and further guidance on planning for fieldwork in a variety of settings can be found on the University's Health & Safety website along with further information about risk assessment: http://www.leeds.ac.uk/safety/fieldwork/index.htm. Contact your Faculty Health and Safety Manager for further advice. See also http://ris.leeds.ac.uk/HealthAndSafetyAdvice.</i>
	X	9.2 Is a Disclosure and Barring Service check required for the researcher? <i>Please note: It is the researcher's responsibility to check whether a DBS check is required and to obtain one if it is needed.</i>
9.3 Any other relevant information		
None		
9.4 Provide details of any ethical issues on which you would like to ask the Committee's advice.		
None		

Section 10: Further details for student projects (complete if applicable)

Your supervisor is required to provide email confirmation that they have read, edited and agree with the form above. It is a good idea to involve your supervisor as much as possible with your application. If you are unsure how to answer any of the questions do ask your supervisors for advice.

10.1 Qualification working towards (indicate with an 'X')		
<input type="checkbox"/>	Bachelor's degree	Module code: <input type="text"/>
<input type="checkbox"/>	Master's degree (including PgCert, PgDip)	
<input type="checkbox"/>	Research degree (ie PhD)	
10.2 Primary supervisor's contact details		
Name (title, first name, last name)		<input type="text"/>
Department/ School/ Institute		<input type="text"/>

Telephone number		
University of Leeds email address		
10.3 Second supervisor's contact details		
Name (title, first name, last name)		
Department/ School/ Institute		
Telephone number		
University of Leeds email address		
Yes	No	10.4 To be completed by the student's supervisor
		The topic merits further research
		I believe that the student has the skills to carry out the research

Section 11: Other members of the research team (complete if applicable)	
Name (title, first name, last name)	Prof Jane Hill
Role (eg PI, Co-I)	Co-I
Department/ School/ Institute	Dept Biology, University of York
Telephone number	
email address	
Name (title, first name, last name)	Dr Rebecca Asare
Role (eg PI, Co-I)	Co-I
Department/ School/ Institute	Nature Conservation Research Centre Ghana
Telephone number	
email address	
Name (title, first name, last name)	Dr Winston Asante
Role (eg PI, Co-I)	Co-I
Department/ School/ Institute	Kwane Nkuru University of Science and Technology Ghana
Telephone number	
email address	
Name (title, first name, last name)	Ms Rosemary Addico
Role (eg PI, Co-I)	Co-I
Department/ School/ Institute	Solidaridad West Africa
Telephone number	
email address	
Name (title, first name, last name)	Dr Guy Ziv
Role (eg PI, Co-I)	Co-I
Department/ School/ Institute	School of Geography, University of Leeds

Telephone number	
University of Leeds email address	
Name (title, first name, last name)	Dr Jennifer Lucey
Role (eg PI, Co-I)	Co-I
Department/ School/ Institute	Dept Biology, University of York
Telephone number	
email address	

Section 12: Supporting documents		
<p>Indicate with an 'X' which supporting documents have been included with your application.</p> <p>Wherever possible the research title on consent forms, information sheets, other supporting documentation and this application should be consistent. The title should make clear (where appropriate) what the research is about. There may be instances where a different title is desirable on information to participants (for example – in projects which necessarily involve an element of deception or if giving the title might skew the results of the research). It is not imperative that the titles are consistent, or detailed, but where possible then they should be.</p> <p>Supporting documents should be saved with a meaningful file name and version control, eg 'Participant_Info_Sheet_v1' or 'Parent_Consent_From_v2'. Refer to the examples at http://ris.leeds.ac.uk/InvolvingResearchParticipants.</p>	X	<p>Information sheet(s)</p> <p><i>Please note: Include different versions for different groups of participants eg for children and adults if applicable. Refer to http://ris.leeds.ac.uk/InvolvingResearchParticipants for guidance in producing participant information sheets.</i></p>
	X	<p>Consent form(s)</p> <p><i>Please note: Include different versions for different groups of participants eg for children and adults if applicable. Refer to http://ris.leeds.ac.uk/InvolvingResearchParticipants for guidance in producing participant consent forms.</i></p>
	n/a	<p>Recruitment materials</p> <p><i>Please note: Eg poster, email etc used to invite people to participate in your research project.</i></p> <p>Invitations were in person at village meetings with smallholder communities, co-ordinated by elected community representatives.</p>
	n/a	<p>Letter/ email seeking permission from host/ gatekeeper</p> <p>Initial requests to hold meetings were made in person to elected community representatives.</p>
	X	Questionnaire/ interview questions
	X	<p>Health and safety risk assessment</p> <p><i>Please note: Risk assessments are a University requirement for all fieldwork taking place off campus. The risk assessment forms and further guidance on planning for fieldwork in a variety of settings can be found on the University's Health & Safety website along with further information about risk assessment: http://www.leeds.ac.uk/safety/fieldwork/index.htm. Contact your Faculty Health and Safety Manager for further advice. Also refer to http://ris.leeds.ac.uk/HealthAndSafetyAdvice.</i></p>
	X	<p>Data management plan</p> <p>Refer to http://library.leeds.ac.uk/research-data-manage.</p>

Section 13: Sharing information for training purposes		
Yes	No	(Indicate with an 'X')
X		I would be content for information in the application to be used for research ethics and research data management training purposes within the University of Leeds. All personal identifiers and references to researchers, funders and research units would be removed.

Section 14: Declaration

1. The information in this form is accurate to the best of my knowledge and belief and I take full responsibility for it.
2. I undertake to abide by the University's [ethical](#) and [health & safety](#) policies and guidelines, and the ethical principles underlying good practice guidelines appropriate to my discipline.
3. If the research is approved I undertake to adhere to the study protocol, the terms of this application and any conditions set out by the Research Ethics Committee.
4. I undertake to ensure that all members of the research team are aware of the ethical issues and the contents of this application form.
5. I undertake to seek an ethical opinion from the REC before implementing any [amendments](#) to the protocol.
6. I undertake to submit progress/ [end of project reports](#) if required.
7. I am aware of my responsibility to be up to date and comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
8. I understand that research records/ data may be subject to inspection for [audit](#) purposes if required in future.
9. I understand that personal data about me as a researcher in this application will be held by the relevant FRECs and that this will be managed according to the principles established in the Data Protection Act.

	Applicant	Student's supervisor (if applicable)
Signature		
Name	Keith Hamer	
Date	24 th August 2016	

HAZARD IDENTIFICATION	
<i>Identify all hazards specific to fieldwork trip and activities, describe existing control measures and identify any further measures required.</i>	
HAZARD(S) IDENTIFIED	CONTROL MEASURES <i>(e.g. alternative work methods, training, supervision, protective equipment)</i>
<p>Nature of the site <i>School, college, university, remote area, laboratory, office, workshop, construction site, farm, etc</i></p> <p>The project will take place on oil palm smallholdings (up to 40ha) within a rural agricultural community growing a variety of different food crops, with a village nearby. Some work will also take place in adjacent forest. There may be some areas of rough terrain (large puddles, fallen branches, stones etc.) on some pathways.</p>	<p>During fieldwork to survey biodiversity, long trousers and stout walking boots will be worn, and researchers will keep to well-marked paths when moving between study sites. In forest, researchers will be accompanied at all times by two experienced forest rangers. Extreme inclement weather will be avoided.</p>
<p>Environmental conditions <i>Extremes of temperature, altitude, exposure to sunlight, potential weather conditions, tidal condition etc</i></p> <p>No mountainous terrain. Temperature is in the mid-20s during the day. Weather can change quickly to rain during the wet season. Tap water is not safe to drink but bottled water is readily available. The area is malarial and it is advised that measures should be taken to reduce insect bites, especially at night when malaria vectors are active. Several venomous snakes and insects are known in the region. The area is poor but political unrest is unlikely.</p>	<p>We will generally be working in the shade of the plantation or forest so will not have high exposure to sunlight. Factor 25+ sunscreen will be worn and replaced as required depending on where we are working (e.g. every hour if in very sunny areas). Accommodation has insect nets on doors and windows and insect spray is used in rooms every night before going to bed. Researchers visiting from the UK will also take anti-malarial prophylaxis.</p> <p>Long legged trousers and long sleeved tops (breathable if possible) will be worn in field to reduce exposure to sun and reduce risk of bites and scratches. Robust boots will be worn at all times while working in the field to protect feet and reduce risks if wildlife is walked on. Waterproof clothing will be carried in the field at all times.</p> <p>Bottled water will be purchased locally and used for drinking and washing both while in accommodation and in the field. At least 1 litre of water will be carried per person while out during the day. Alcohol wipes and a basic first aid kit will also be carried.</p>
<p>Site specific conditions <i>e.g. cliffs, scree, bogs, featureless landscapes, local endemic infectious diseases, zoonoses etc</i></p>	<p>During fieldwork to survey biodiversity, long trousers and stout walking boots will be worn, and researchers will keep to well-marked paths when moving between</p>

<p>The project will take place on oil palm smallholdings (up to 40ha) within a rural agricultural community growing a variety of different food crops, with a village nearby. Some work will also take place in adjacent forest. There may be some areas of rough terrain (large puddles, fallen branches, stones etc.) on some pathways.</p> <p>Venomous snakes and dangerous insects are not common but are potentially present, more so in rainforest than plantations. Rainforest areas can be very disorientating to work in</p>	<p>study sites. In forest, researchers will be accompanied at all times by two experienced forest rangers. Extreme inclement weather will be avoided.</p> <p>Snakes are unlikely to approach and will not be approached if seen. Standard advice for work in such areas (do not place foot or hands where cannot see, wear robust clothing, carefully assess working area before placing traps) will be taken and followed to reduce risk of contact with dangerous animals.</p> <p>While working in forest areas we will be accompanied by two experienced forest rangers, we will carry mobile phones and will use only well-marked paths to reduce risk of getting lost. A map will be carried along with electronic mapping to ensure accurate position fixing as well as a 2-way radio.</p>
<p>Process <i>Operating machinery, electrical equipment, driving vehicles, handling or working with animals etc</i></p>	<p>No electrical equipment or machinery will be used. Both researchers have received training in butterfly sampling.</p>
<p>Biodiversity surveys will entail trapping and handling live butterflies using bananas as bait.</p>	
<p>Transport <i>Mode of transport while on site, to and from site, carriage of dangerous goods etc</i></p>	<p>Travel will be by four-wheel drive vehicle owned by NCRC with an experienced driver employed for the purpose by NCRC. Plenty of food and water supplies will be taken to every site. University of Leeds staff and students will not be involved in driving.</p>
<p>Access to farms will be by vehicle. Domestic cows are free to wander on roads, and side roads are less well maintained.</p>	
<p>Equipment <i>manual handling risks, operation of machinery, tools, use of specialist equipment etc</i></p>	<p>Stout boots and gloves will be worn for spade work (digging soil samples for termites). There will be no heavy lifting required.</p>
<p>No specialist machinery or tools will be used. Birds will be sampled by observation through binoculars from a standing position; butterflies using light-weight netting traps; ants using pit-fall traps comprising a 1cm diameter plastic tube embedded vertically in the soil and half-filled with water; termites by manual sorting of soil (1m² to depth of 10cm, dug with a spade and placed on plastic sheeting for sorting).</p>	

Violence <i>potential for violence (previous incidents etc)</i>	<p>Caution will be taken to remain on study farms, as indicated by farmers or their representatives, and not to trespass on any other farmers' land. A mobile phone will be carried at all times in case of emergency (coverage is excellent at all study sites). Information from research field centre suggests that local people have never behaved in a threatening manner, they are in general friendly and helpful and it is not an area of political unrest or terrorist activity.</p>
<p>Study farms are private. We have excellent relations with our two focal farming communities and our local project partners have worked successfully with them on a number of previous similar projects. As such there is expected to be no conflict from farmers or the public.</p>	
Individual(s) <i>medical condition(s), young, inexperienced, disabilities etc</i>	<p>Our researchers have previous experience of conducting interviews with smallholders and of all proposed biodiversity sampling methods.</p>
<p>No known medical conditions. Both researchers are graduates and one has worked for the past three years with our two focal communities on a NERC ESPA project on cocoa.</p>	
Work Pattern <i>time and location e.g. shift work, work at night</i>	<p>All work will be during the daytime. Work will not exceed 37 hours per week but may include early/late/weekend shifts depending on the weather etc. Throughout the week sufficient breaks will be taken to reduce the risk of fatigue.</p>
Permissions Required <i>Contact details, restrictions and details of permissions</i>	<p>Work in plantations will be carried out with the consent of the appropriate farmer in each case. We have consent from the local forestry service for work in rainforest.</p>
Other Specific Risk Assessments <i>e.g. COSHH, Manual Handling, Lone Working if so what is identified in these assessments? Are there training requirements? (cross reference where appropriate)</i>	<p>None required currently. Should a need arise this will be discussed remotely with the project supervisor and risk assessed completed as required so that safe working procedures can be put in place.</p>
Health Questionnaire Completed <i>Is it required and has it been completed, who by and where is it recorded</i>	<p>Standard University of Leeds Health Questionnaire completed.</p>
Health Surveillance Required <i>Is it required and has it been completed, who by and recorded</i>	<p>None required</p>

Vaccinations Required <i>Obtained and certificate where applicable</i>	All UK workers to arrange these before leaving.
Specialist vaccinations: Rabies, Yellow Fever, Typhoid Routine vaccinations: Diphtheria/Polio/Tetanus, Hepatitis A, Meningitis, MMR	
First Aid Provision <i>Requirement for first aid or specialist first aid equipment, access to medical equipment and hospitals</i>	We take a first aid kit to field with plasters, bandages, antiseptic and wound dressings. There are 3 or more doctor's clinics in the town that are well supplied, and several hospitals nearby on the plantations.

Additional Supporting Information	
Pre-departure Briefing <i>Carried out and attended</i>	This will be conducted before commencing fieldwork in September.
Training <i>Identify level and extent of information; instruction and training required consider experience of workers, details of relevant training</i>	Researchers have previous experience of methods to be used and have received/will receive additional training before commencing fieldwork.
Biodiversity surveys	
FCO advice <i>Include current FCO advice for travel to the area where applicable</i>	General threat from terrorism with recent attacks in some other West African countries but not in Ghana. Localised outbreaks of civil unrest can occur in the north of the country, but not within our study region.
Supervision <i>Identify level of supervision required e.g. full time, Periodic telephone/radio contact</i>	Researchers will be directly supervised in the field at start of biodiversity surveying. They will work together, accompanied by a driver and, in forest, an experienced forest ranger. They will inform staff at the research quarters of their plans and expected return time each day, and carry a mobile phone at all times with emergency contact details. They will communicate with local and UK supervisors on a weekly basis by phone, text, Skype or email as appropriate.
Weekly communication with both local and UK supervisors.	
Other Controls <i>e.g. background checks for site visits, embassy registration</i>	
None	

<p>Identify Persons at Risk <i>This may include more individuals than the fieldwork participants e.g. other employees of partner organisations</i></p> <p>Copy of other Organisation's risk assessment attached?</p>	<p>Our work will not impact on other Field Centre staff or students. Our traps present no hazard and will be located away from regular thoroughfares.</p>
<p>Additional Information <i>Relevant to the one working activity including existing control measures; information instruction and training received, supervision, security, increased lighting, emergency procedures, access to potable water etc.</i></p>	<p>There is good mobile phone coverage and emergency vehicular access throughout the study area.</p>

<p>Residual Risk <i>Is the residual risk acceptable with the identified controls?</i></p>	<p>Yes</p>	
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<p>Assessment carried out by</p>	Name:	Keith Hamer
	Signature:	
	Date:	
<p>Names of person(s) involved in Fieldwork <i>N.B: This can take the form of a signed class register when large group work</i></p>	Name:	Michael Adu Sasu; Linda Ofosuhene
	Signature:	
	Date:	
<p>Fieldwork Activity Organiser / Course Leader <i>e.g. PI, etc</i></p>	Name:	Keith Hamer
	Signature:	
	Date:	

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number.	
Have you involved your partners in preparation of the report and named the main contributors	
Have you completed the Project Expenditure table fully?	
Do not include claim forms or other communications with this report.	

Impacts of Crop Management on Smallholder Oil Palm Yields and Biodiversity

Data Management Plan

Research project and context

Growing markets in sustainably-sourced palm oil provide ideal opportunities for smallholders in Ghana to boost their incomes through take-up of best agricultural practice (BAP) to increase yields and reduce economic and environmental costs of reliance on fertilizers and pesticides. However, smallholder uptake of BAP is very low, and the reasons for this poor uptake are currently unclear. Hence an integral part of this project will be a survey of smallholder communities to assess the drivers and constraints of variation in adoption of BAP and to quantify the relationship between adoption of BAP and crop yields. An additional component of the work will be to survey birds, butterflies, ants and termites on selected smallholdings differing in agricultural practice, to assess potential co-benefits of BAP for biodiversity.

Types and formats of data

Data will be obtained by structured interviews (20-30 mins) with ca 100 oil palm smallholders in focal agricultural communities within the High Forest Zone of Ghana (the key region for growing oil palm). At 40 of these smallholdings and nearby sites within protected rainforest, additional data will be obtained on biodiversity of birds, butterflies, ants and termites. The file formats for live data during the project will be Excel spreadsheets, copied to CSV format for analysis in R.

Standards and methods for data collection and documentation

Consent forms for interviews will be signed by each participant to ensure an appropriate balance between participant confidentiality and data reuse. Appropriate meta-data will be created for interviews. These data will include a unique participant identifier code but no information allowing any participants to be recognized.

Data quality, security and storage

Researchers collecting interview data are bilingual and interviews will be carried out either in English or Twi (the local Ghanaian language) according to the preference of the interviewee. Completed questionnaire forms will be digitized as soon as possible and original paper copies securely retained at the offices of our project partner and manager (Dr Rebecca Asare, Nature Conservation Research Centre) in Ghana. We anticipate from previous experience that ~ 50% of ant species identified by the project will not have been described taxonomically; these new species will be uploaded to a freely-accessible global online database (<http://www.antweb.org>) with full descriptions and images, and assigned reference numbers within the collection. Similar rates of discovery of new species are also likely for termites, and a fully-catalogued reference collection of insect voucher specimens will be deposited at the Kwame Nkrumah University of Science and Technology, Ghana (project partner Dr

Winston Asante). Other biodiversity data arising from the project will be shared in freely accessible formats via the Global Biodiversity Information Facility (<http://www.gbif.org/>).

Data backup and security

Data will be digitised at NCRC's research station where researchers will be based during fieldwork, with backup on an encrypted memory stick, and transferred electronically to Leeds as quickly as possible (the research station has very good internet connection). Data will then be stored on a University of Leeds server (M: or N: drive) in a physically secure location with appropriate regular back-ups to tape.

Data archiving

Data will be submitted to a suitable repository (e.g. Dryad) accompanied by appropriate metadata.

Data sharing

No problems are anticipated with regard to the sharing of (anonymised) interview transcripts with other researchers. Informed consent, including provision for data sharing, on the basis of assurances of confidentiality and anonymity and strict control of access to the data, will help to ensure that problems do not arise.

Ethical considerations

The project will undergo full ethical review at the University of Leeds in order to gain institutional approval. All interview data will be anonymised using numerical participant identifiers. No sensitive data (as defined by the Data Protection Act 1998) will be collected by this project.

Data ownership

The intellectual property of the data generated will remain with the University of Leeds. The University policy on the management of research data requires all data arising from research projects to be made openly available where possible. The research will not use any data that are covered by the Copyright, Designs and Patents Act 1988 or any other similar legislation.

Responsibilities

The PI will have overall responsibility for implementing the data management plan. The Faculty IT Manager will be responsible for ensuring that electronic file permissions have been correctly assigned and for advising on other aspects of data storage and security. Staff involved in the project at participating institutions will be responsible for following data management procedures.



Solidaridad



Impacts of Crop Management on Smallholder Oil Palm Yields and Biodiversity

Funded by UK Darwin Initiative; 1st April 2016 – 31st March 2019

By promoting best agricultural practice that boosts yields, minimises environmental damage and supports certification with the Roundtable for Sustainable Palm Oil (RSPO), this project aims to increase incomes and welfare of Ghanaian oil-palm smallholders and provide co-benefits for biodiversity.

Growing markets in sustainably-sourced palm oil provide opportunities for smallholders to boost their incomes through take-up of best agricultural practice (BAP) to increase yields and reduce economic and environmental costs of reliance on fertilizers and pesticides. However, smallholder uptake of BAP is very low, and the reasons for this poor uptake are currently unclear.



We wish to survey smallholders to assess the reasons for variation in how crops are managed and to quantify the relationship between crop management and yields. We then wish to survey birds, butterflies, ants and termites on selected smallholdings differing in agricultural practice, to assess potential co-benefits of BAP for biodiversity. In this way, we aim to improve the scientific understanding and take-up of BAP for oil-palm smallholders, boosting crop yields and increasing household incomes whilst also increasing biodiversity.

Biodiversity surveys

On each selected smallholding, we will survey species associated with oil palms on two occasions, once in the wet season and once in the dry season, in the following ways:

Birds – One observer will walk at a constant pace, stopping every 100m to record birds seen or heard during a period of 10 minutes. This will take place early in the morning, when birds are most active. The observer will use binoculars and may make sound recordings of calls made by some birds, to help identify species.

Butterflies – We will hang a butterfly trap baited with bananas at a height of about 2m beneath two palms on each selected smallholding. We will then visit each trap once daily for 10 days to remove any captured butterflies. Most will be identified straight away, given a small mark on the wing (so we can tell if we capture them again) and released. A few may need to be kept so we can identify them later.

Ants – These will be collected in 10 small plastic tubes, each half-filled with water and buried flush with the soil surface for a period of 5 days.

Termites – These will be collected by digging one square metre of soil to a depth of 10cm, placing it on some plastic sheeting and sorting by hand.



Some questions you may have

- *If I say yes to participating, what will this involve?* You'll be asked to complete a questionnaire with the help of one of our research fellows (Michael and Linda). This should take about 20-30 minutes. You won't be asked for anything else other than permission for us to survey biodiversity on your smallholding as described above.
- *Where and when will we complete the questionnaire?* It could be your house or any other place where you usually spend your time, wherever you feel most comfortable. You can also choose a good time to meet.
- *What happens if I change my mind?* If you haven't completed the questionnaire, your name will be removed from our list of participants. If you have, the paper copy of the form will be destroyed. However, the anonymised data (with your name replaced by a three-digit code) will be retained in electronic format for use in the project.

Project partners: University of Leeds, UK; Nature Conservation Research Centre, Ghana; University of York, UK; Kwame Nkrumah University of Science and Technology, Ghana; Solidaridad West Africa; Roundtable for



Consent to take part in research project on the Impacts of Crop Management on Smallholder Oil Palm Yields and Biodiversity

Add your initials next to the statement if you agree

<p>I confirm that I have read and understand the information sheet explaining the above research project and I have had the opportunity to ask questions about the project.</p>	
<p>I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. I can indicate a wish to withdraw by informing either of the project's two community liaison staff or one of my local community representatives. All questionnaire sheets completed by me will then be destroyed. However, anonymised questionnaire data and biodiversity data will be retained in an electronic format for future use by the project.</p>	
<p>I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. I understand that my responses will be kept strictly confidential.</p>	
<p>I give permission for members of the research team to carry out biodiversity surveys for birds, butterflies, ants and termites on my smallholding as described in the project information leaflet.</p>	
<p>I agree for the data collected from me to be stored and used in relevant future research in an anonymised form.</p>	
<p>I understand that relevant sections of the data collected during the study may be looked at in anonymised format by individuals from the University of Leeds or from regulatory authorities where it is relevant to my taking part in this research. I give permission for these individuals to have access to my anonymised records.</p>	
<p>I agree to take part in the above research project and will inform community liaison staff should my contact details change.</p>	

Name of participant	
Participant's signature	
Name of community liaison staff	
Signature	
Date*	

*To be signed and dated in the presence of the participant. Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form and the project information sheet. A copy of the signed and dated consent form should be kept with the completed questionnaire form, which must be kept in a secure location.



Impacts of Crop Management on Smallholder Oil Palm Yields and Biodiversity

Smallholder Questionnaire

Name:

GPS Location of smallholding:

Part 1: Questions about you

1. Your age

21-30	31-40	41-50	51-60	61-70	71+
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2. Your gender

Male	Female
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3. Your formal education

Primary school	Secondary school	College	University
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4. The number of people in your household, including yourself:

5. The number of these people, including yourself, who regularly help with farm work:

6. Are you enrolled on a programme of 'Best Agricultural Practice' for oil palm?

Yes: I'm currently enrolled	No: I used to be enrolled, but not any more	No: I've never been enrolled
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7. If you are currently enrolled, what's the main reason why?

8. If you are not currently enrolled, what's the main reason why not?

9. Which of the following statements best describes how you feel about the time you spend managing your oil palms?

I don't get to spend enough time looking after my crop	I spend the right amount of time looking after my crop	I spend too much time looking after my crop
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10. Which of the following statements best describes how you feel about the biodiversity (wild animals and plants) on your farm?

I'd like to see less biodiversity on my farm	I think there's about the right amount of biodiversity on my farm	I'd like to see more biodiversity on my farm
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Part 2: Questions about your farm

1. Roughly how big is your farm?
2. How big is the area you've planted with oil palm?
3. How many oil palms are you growing there?
4. How long have you been growing oil palm there?
5. What was previously growing there?
6. Is the land owned or rented by you?

Owned	Rented
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7. If rented, do you pay the landowner a fixed rent or a proportion of your income from the crop?

Fixed rent	Proportion of income
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Part 3: Questions about how you manage your oil palm crop

1. How many days per week do you spend managing your crop?

2. Do you weed your crop manually and if so, how often?
3. Do you clear a circle around the base of each palm trunk?
4. Do you apply chemical herbicides and if so, how much and how often?
5. Do you apply chemical pesticides and if so, how much and how often?
6. Do you apply chemical fertilizer and if so, how much and how often?
7. Do you create a contour around each palm trunk to help prevent fertilizer etc flowing away?
8. Do you apply empty fruit bunches and if so, how do you apply them?
8. Do you plant any leguminous cover crop beneath your palms?
9. How often do you prune each palm stem?
10. What do you do with the cut fronds?
11. Do you remove ferns and other vegetation from the trunks of the palms?
12. How often do you, or whoever picks your fruit for you, harvest fruit bunches from each stem?

Number of days between harvests:	Number of harvests per month:
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13. How do you harvest your fruit?
14. Do you have a regular harvesting route along a set path?

14. Which of the following statements best describes the vegetation in between your oil palm stems?

The vegetation is very short (below ankle height) with no woody stems	The vegetation is quite long (up to waist height) with occasional woody stems	The vegetation is very long (above waist height) with frequent woody stems
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Part 4: Questions about your fruit yield

1. What weight of oil palm fruit do you obtain each month on average from your smallholding?
2. How many fresh fruit bunches do you harvest per month on average from each stem?
3. What's the average weight of each fresh fruit bunch?
4. How do you measure the weight of each bunch?
Weigh with a scale [] Estimate [] Not measured []

Annex 11; Anonymised Smallholder Questionnaire Data

Example data for five smallholders; the full spreadsheet contains >100 entries. Additional data such as GPS co-ordinates have been recorded but are not shown, to maintain smallholder anonymity. Separate Excel file.

Annex 12; Example of monthly Biodiversity Spreadsheets

Butterflies sampled in oil palm over the period 5 – 19 April 2017. Separate Excel file

Annex 13; Letter seeking consent for work in rain forest within Kakum National Park

Permission subsequently granted; sampling will commence shortly. Separate PDF